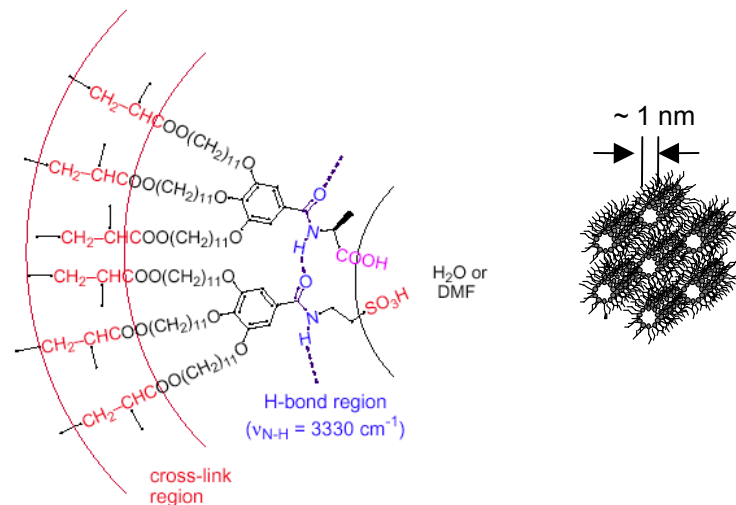


# Nanostructured Polymers for Brønsted and Lewis Acid Catalysis via Monomer Self-assembly

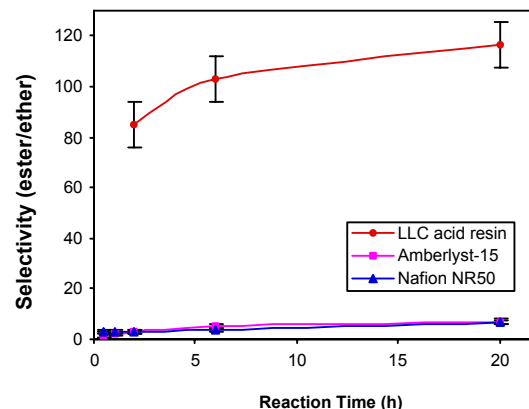
Douglas Gin, University of Colorado at Boulder, DMR-0111193

Heterogeneous acid catalysis is important in both industry and academia. Zeolites are widely used as solid acid catalysts because of the high reaction selectivity generated by their regular nanostructure. Polymeric acid resins (e.g., Nafion, Amberlyst) are also widely used because of their ease of fabrication, but these amorphous catalysts lack the selectivity of zeolites. We have synthesized the first example of a nanostructured, solid acid resin via the cross-linking of H-bond templated acidic lyotropic liquid crystals. The resulting nanoporous acid resin was found to have much higher selectivity than amorphous acid resins in esterification test reactions.

*J. Am. Chem. Soc.* 2004, 126 (6), 1616.  
(*C&E News* 2004, 82 (9), 36.)



Nanostructured acid resin via H-bond assisted LLC assembly.



Higher ester-to-ether product selectivity of LC acid resin in the reaction of benzyl alcohol with 1-hexanoic acid.

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## Education:

Currently, two graduate students are being partially supported by this NSF grant: Mr. Yanjie Xu (ChE) and Mr. Cory Pecinovsky (Chem).

With partial support from this grant, one graduate student has completed his Ph.D. degree: Dr. Alan Sentman (postdoc at IBM Almaden); one postdoctoral researcher has been trained: Dr. Weiqiang Gu (Waters Corp.); and one REU undergraduate student has been supported: Mr. Cory Pecinovsky (Abilene Christian College, prior to entering grad school at CU). This past year, I taught Physical Organic Chemistry for first-year Chem graduate students, and a joint undergraduate/graduate Polymer Chemistry course in ChE. As a 50/50 faculty member in both the Chem) and ChE departments, I have been successfully integrating aspects of both disciplines into the courses I teach at CU, so that the students receive cross-disciplinary training.

## Outreach:

In addition to REU students, RET researchers have also worked in my labs over the past 3 summers in a joint effort with the CU Boulder Ferroelectric LC Materials Research Center's outreach program. This summer, Mr. Rob Kerr, a high school teacher from Kent, OH, is working as an RET researcher in our labs again. Also, an undergraduate summer researcher, Mr. Garret Nicodemus, is being supported for 2 months from this grant. Other prior outreach activities under this grant included a cooperative project with the Colorado Commission on Higher Education last year. The goal was to develop demonstrations suitable for high schools to educate students on nanoscale phenomena. We used our LLC technology to make polymer membranes that can separate colored dye molecules in water based on molecular size.